

Patent claims

1. A micromixer for mixing at least two fluids which react to form precipitates or suspensions, having a first channel for supplying a first sub-flow (6) and having a second channel for supplying a second sub-flow (7), which open in flat entry gaps (19, 20) into a mixing and reaction zone (10) and leave the mixing and reaction zone (10) via an outlet channel (11), characterized in that a reflux barrier is arranged between the mixing and reaction zone (10) and at least one channel for supplying a sub-flow (6, 7, 37).
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2. The micromixer as claimed in claim 1, characterized in that the reflux barrier is designed as a non-return valve.
- 10 3. The micromixer as claimed in claim 2, characterized in that the prestress of the non-return valve is provided by mechanical means (13, 14, 15).
4. The micromixer as claimed in claim 2, characterized in that the non-return valve is electrically, pneumatically, hydraulically or electromagnetically drivable.
- 15 5. The micromixer as claimed in one or more of claims 1 to 4, characterized in that the non-return valve is designed as a membrane arrangement.
6. The micromixer as claimed in one or more of claims 1 to 5, characterized in that deposits are cleaned from the reflux barrier in the course of operation by cleaning pins, which insert into the opening uncovered by the reflux barrier during each opening and closing process and are essentially designed with a needle shape.
- 20 7. The micromixer as claimed in one or more of claims 1 to 6, characterized in that entry gaps (19, 20) for the sub-flows (6, 7, 37) are designed as narrow annular gaps, so that the sub-flows (6, 7, 37) meet each other as thin film layers.
8. The micromixer as claimed in one or more of claims 1 to 7, characterized in that the entry gaps (19, 20) are bounded by microstructured components (16, 9), which contribute to dividing the sub-flows (6, 7, 37) into individual sub-streams.
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9. The micromixer as claimed in one or more of claims 1 to 8, characterized in that the outlet channel (11) has a smooth and widening geometry.
10. The micromixer as claimed in one or more of claims 1 to 9, characterized in that a feed for an envelope stream, which encloses the mixed sub-flows (6, 7, 37) when they emerge, is provided in the outlet channel (11).
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11. The micromixer as claimed in one or more of claims 1 to 10, characterized in that the response pressure and/or the opening behavior of the reflux barrier, the width of at least one of the inlet gaps and/or the characteristic dimensions of the mixing and reaction zone are externally adjustable by mechanical, hydraulic, pneumatic, electrical or electromagnetic means and/or are automatically varied as control variables of an outer or inner control loop.
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12. The micromixer as claimed in one or more of claims 1 to 12, characterized in that two or more valve mixer units according to the invention are arranged in a common housing with common supplies of the sub-flows and a common outlet channel, so that they can be operated in parallel.
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13. The use of the micromixer as claimed in one or more of claims 1 to 13 for precipitation and/or crystallization reactions, the preparation of nanoparticles, carbon nanotubes, fullerenes or particles/nanoparticles having a plurality of layers of different substances arranged in a concentric sequence.
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